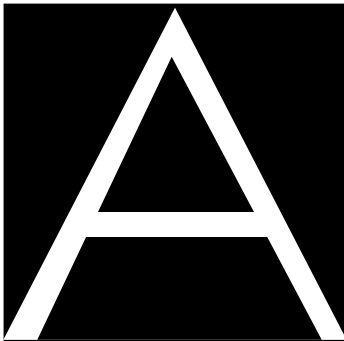


EEL 6814

HMW # 2

Due September 24, 2024

- 1- In a 16x16 grid, select by hand the parameters of a two hidden layer MLP with signum units (threshold nonlinearity) with two inputs and one output to mimic the space partition shown in Fig. 1 (assume that the center of the figure is (0,0)). State the smallest number of hidden units the network needs in each layer and explain their role in creating the mask. Assume that black is -1 and white is 1 (or 0 and 1). Can you achieve the same goal with a single hidden layer network? Justify your answer.



- 2- Code the backpropagation algorithm and test it in the following 2 class problem. Use a single hidden layer MLP and specify the size of the hidden layer and tell why you select that number of hidden PEs. Note that you only have 8 input patterns, which may be too little, but it is a good start. This problem is called the STAR problem.

x1	x2	d
1	0	1
0	1	1
-1	0	1
0	-1	1
0.5	0.5	0
-0.5	0.5	0
0.5	-0.5	0
-0.5	-0.5	0

I expect that the system learns this pattern exactly (sometimes). Estimate the location of the separation lines in the space of the data. Describe your experience. Is there just one possible solution (i.e. a single set of parameters) to exactly separate the two classes of given points? Now that you know the location of the decision regions that shatter the data, augment the input data set to make the performance of the MLP more robust, and with faster training. Show experimentally the improvement.